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STATISTICAL BULLETIN
Metropolitan Life Insurance Co.

VOL. XIII JUNE, 1932 No. 6

HOW WELL DO INSURANCE STATISTICS REFLECT GENERAL MORTALITY?

For many years, the Metropolitan Life Insurance Company has issued monthly and annual reports on the mortality among its Industrial policyholders. It has hoped in this way, to inform the country on the current health conditions throughout the United States and Canada. The Company is in this regard in a singularly favorable position. Its Industrial policyholders are scattered over the entire territory of the two countries, where they constitute a seventh of the total population. The records of mortality are received shortly after the death of the insured and are immediately tabulated. On the other hand, similar tabulations by the Federal and State Governments and their publication are necessarily delayed months and sometimes years. The Company has, therefore, been encouraged to issue its reports as an index of the current deathrate of the general population. For many years, observation has indicated a very close parallelism between the fluctuations in the mortality among the insured and that in the general population. Thus the deathrates among the policyholders place in our hands, as it were, a clinical thermometer by which to gauge the general health of the nation. But this thermometer has not hitherto been "calibrated," that is, we have not had any numerical measure of its accuracy, nor have we had a scale by which to translate readings made on the policyholders into corresponding readings representative of the general population. The results of such a calibration are now presented to our readers and henceforth we shall know how reliable our index is.

What is needed is a statistical measure of the deathrate in the general population of the United States corresponding to any particular deathrate observed among the Industrial policyholders of the Metropolitan Life Insurance Company. It is not, of course, to be expected, that, whenever the deathrate among the Industrial policy-

holders has some particular value, such as nine per thousand per annum,* the corresponding deathrate in the general population will have *exactly* some other value, such as for example eight per thousand. What actually will happen is that the deathrates in the general population associated with a deathrate of nine per thousand among policyholders will scatter over some more or less restricted range, centering about some mean value, such as about eight. The more perfect the relation between the two rates, the narrower will be the range over which the rates in the general population scatter for a given rate among our policyholders. A measure of the closeness of this scatter, or, as we might say, of the perfection of the relation between the two deathrates, is given by a numerical index known as the coefficient of correlation. This has the value *unity* for perfect correlation, in which a given value of one rate would correspond exactly to one definite value of the other. Less perfect relations are typified by coefficients less than unity, but a coefficient closely approaching unity means a high degree of correlation.

The coefficient of correlation between the annual deathrates in the United States and those among the Industrial policyholders of the Company during the period of years 1911 to 1929 has been computed by the usual technique, and is found to be exceedingly high, namely, $.985 \pm .007$. The extremely high degree of the correlation here found may be appreciated when we consider that it is closer than even that, for example, between the measurements of certain bones in the right and in the left hand of the same person, which exhibit a correlation coefficient of .925.

The close correlation found does not mean that the deathrates among the Industrial policyholders are *identical* with those of the general population, but only that there is a definite and constant relation between them. As a matter of fact the Metropolitan Industrial policyholders are mainly urban dwellers, and as such have a deathrate somewhat above the general average which includes also the entire rural population. But the same technique by which the coefficient of correlation is obtained, yields us also the so-called *regression equation*, by means of which the general population deathrate corresponding to a particular value of the Industrial deathrate is easily computed. As based upon the standardized annual rates for the series of years 1911–1929, for all persons within the age limit one to seventy-four years, the equation takes the form

$$d_g = .5109\, d_i + 3.283$$

*Standardized mortality rate for persons of ages one to seventy-four.

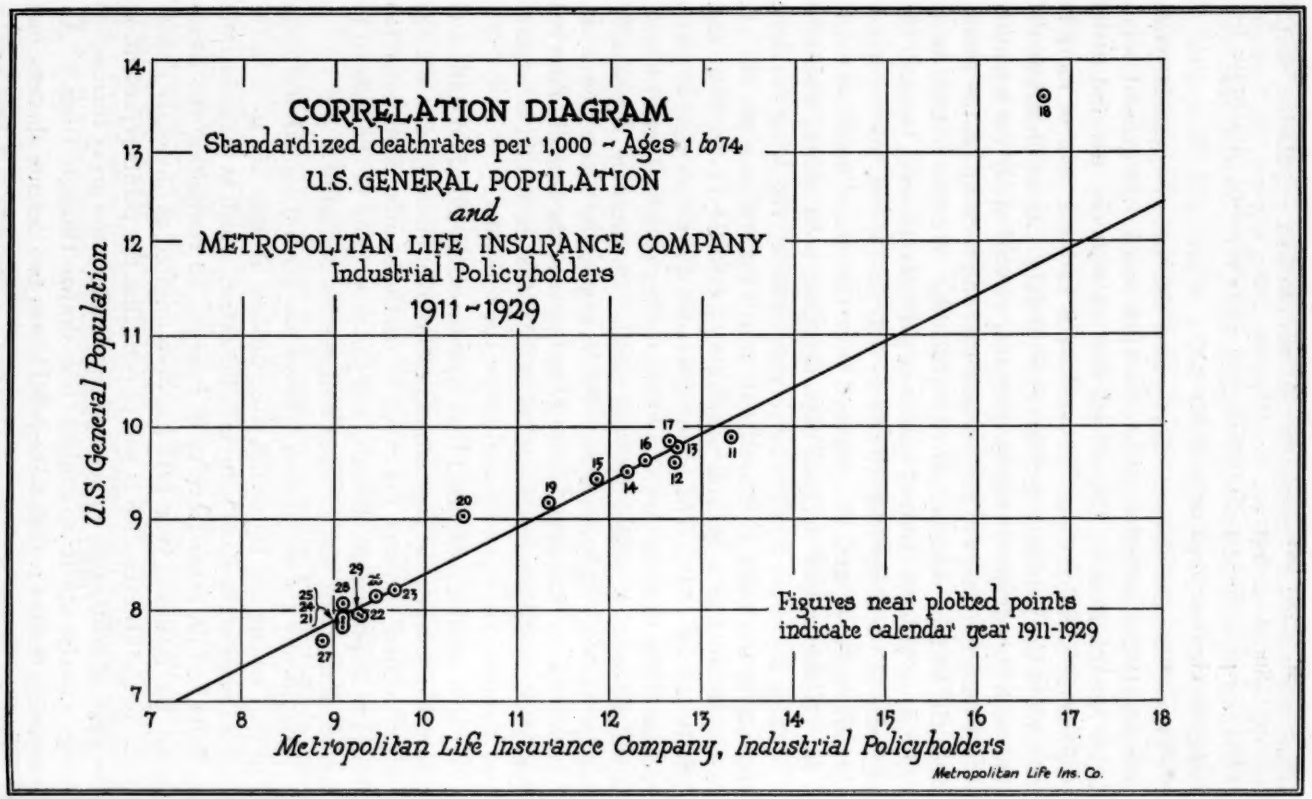
where the symbol d_g represents the standardized population deathrate per 1,000, and d_i represents the corresponding deathrate per 1,000 among Industrial policyholders.

This equation enables us, shortly after the close of a calendar year, to estimate the annual deathrate for that year in the general population on the basis of the annual deathrate among our Industrial policyholders, which, from current data, is known a year or more in advance of the publication of the Federal data. As an illustration of how such an advance estimate operates, we may apply the equation to the data for the year 1929, where we can check up on the result, since the Federal data are already available. We thus obtain, as an estimate of the standardized deathrate per 1,000 persons, between the ages one and seventy-four, the figure 8.02 ± .14, whereas the figure for this range of ages, as computed from the official publications, is 7.95. If the second decimal were dropped, both values would be 8.0, which shows our index to be very serviceable. Applying the same formula to the years 1930 and 1931, where Federal data are not yet available, we find a general deathrate of 7.66 ± .14 for 1930 and 7.63 ± .14 for 1931. The figures preceded by the ± sign in these rates indicate in each case the corresponding standard error, which, it will be seen, is relatively very small. Its meaning is probably familiar to many of our readers. For example, the figure 7.66 ± .14 for 1930 means that the odds are 22 to 1 against the actually observed deathrate falling above 7.94 or below 7.38, that is, within a range of two standard errors above and below the estimate.

It is, of course, recognized that insurance data afford no statistical measure of the general population deathrate in infancy, or in the age ranges beyond 75 years, inasmuch as deaths of infants are excluded from the insurance tabulations, and the proportion of the insured in the residual group, age 75 years and over, is negligible.

Graphically the correlation between the general annual deathrate and that among our Industrial policyholders at ages one to seventy-four is shown in the accompanying illustration, which at the same time exhibits certain other features of interest. In computing the correlation, the influenza year 1918 has been omitted as obviously abnormal. With this exception it will be seen that the points representing the pairs of deathrates for successive calendar years array themselves rather closely about a straight line drawn through them.* An interesting feature is that these points form two definite clusters, one

*This line is computed by the method of least squares as the straight line of closest fit, and is known as the *regression line.*


CORRELATION DIAGRAM
Standardized deathrates per 1,000 ~ Ages 1 to 74
U.S. GENERAL POPULATION
and
METROPOLITAN LIFE INSURANCE COMPANY
Industrial Policyholders
1911 ~ 1929
Figures near plotted points indicate calendar year 1911-1929
U.S. General Population
Metropolitan Life Insurance Company, Industrial Policyholders
Metropolitan Life Ins. Co.

to the right of the point for 1920, comprising all the years prior to the severe influenza pandemic of 1918; the second cluster, to the left of 1920, comprising the years subsequent to 1920. The year 1920 itself was also characterized by a rather heavy influenza epidemic, and, as will be seen on the diagram, it also falls somewhat out of line with the general array of points.

It is after all little wonder that a group of people so large as the body of our Industrial policyholders should reflect very closely what is happening in the general population. With the above demonstration of the numerical correspondence between the two series of figures, we hope that still more of those engaged in the field of public health and preventive medicine will avail themselves of the current publications of the Metropolitan Life Insurance Company as a broad measure of the general health situation.

PELLAGRA MORTALITY AMONG WAGE-EARNERS

Facts available up to the present time concerning the pellagra deathrates in 1930 and 1931, indicate that there has been a decline during these years. This is true, at any rate, for the wage-earning populations of the cities in those states in which pellagra is an important cause of death. Furthermore, the mortality rate has dropped in the general population of a group of three Southern states where pellagra has been an important cause of death. It is, indeed, remarkable that the mortality rate for this disease did not increase in view of the unfavorable business conditions which prevailed—particularly in 1931. These gave rise to widespread unemployment, with its heaviest incidence among wage-earners and their families; and must have affected very markedly their ability to maintain a pellagra preventive diet. For pellagra, it should be remembered, is a disease due to a diet deficient in vitamins found normally in fresh, lean meat, milk, and yeast—among other foods; and it might be expected that in view of reduced incomes these foods would not be so readily obtainable and that sickness and death from pellagra would be more common.

The disease is characterized by digestive disturbances, skin lesions, and in many cases by extreme weakness and debility, spinal pain, convulsions, melancholia and idiocy. The mortality data presented in the table on page 6 include deaths certified as due to insanity of pellagra, as well as those from the disease proper.

The deathrate from pellagra among Metropolitan Industrial policyholders exhibits no continuous trend for the twenty-one year period 1911 to 1931. The highest deathrates were recorded in 1914

Metropolitan Life Insurance Company, Industrial Policyholders
Metropolitan Life Ins. Co.

and 1915 which were years of below-average business conditions. But the facts do not show that the higher mortality rates always come when business is at a low ebb. This is demonstrated by the low deathrates which prevailed in 1921 and 1930–1931. During the World War, when employment was general and high wages prevailed, the pellagra deathrate declined; and the downward tendency continued until 1924 when the lowest rate of the twenty-one year period was recorded. Then, for five years, the mortality curve again took an upward course. But in 1930 and 1931, in the face of widespread economic disturbances, deaths from pellagra declined quite in line with the general deathrate.

Standardized Deathrates per 100,000 from Pellagra. By Color and Sex. For Age Periods 1 to 74 and 45 to 74 Years.

Metropolitan Life Insurance Company. Industrial Department, Weekly Premium-Paying Business 1911 to 1931.

Year	Total Industrial Department		White				Colored			
			Males		Females		Males		Females	
	1 to 74	45 to 74	1 to 74	45 to 74	1 to 74	45 to 74	1 to 74	45 to 74	1 to 74	45 to 74
1931	1.9	5.3	1.3	5.1	1.2	3.2	4.7	18.0	12.2	27.4
1930	2.2	6.2	1.3	5.1	1.8	5.1	5.2	20.0	11.7	24.8
1929	2.5	7.2	1.6	5.7	2.0	5.4	5.3	21.6	15.4	39.5
1928	2.5	7.2	1.6	6.3	2.2	5.8	5.3	20.9	13.3	26.7
1927	2.1	6.4	1.4	5.7	1.9	5.4	2.7	12.2	10.3	23.7
1926	1.8	5.2	1.0	3.3	2.0	6.3	2.1	6.2	7.7	13.9
1925	1.5	4.6	1.0	4.6	1.4	3.8	2.2	8.1	6.9	13.8
1924	1.3	3.3	.9	3.0	1.2	2.9	1.2	6.1	5.8	10.1
1923	1.4	3.9	.8	3.0	1.4	3.9	1.3	3.3	7.2	14.9
1922	1.5	4.2	1.0	3.7	1.2	3.6	2.6	7.7	7.8	16.8
1921	1.6	4.4	.9	3.5	1.5	3.9	2.0	6.1	9.2	21.1
1920	1.7	4.9	1.0	3.8	1.8	4.9	1.7	7.3	7.9	16.4
1919	2.1	6.1	1.1	4.2	2.1	5.9	3.5	10.0	11.4	28.6
1918	4.3	10.6	2.3	8.7	4.4	9.5	7.6	21.3	19.9	41.3
1917	3.9	10.9	2.1	8.0	3.8	10.5	5.6	18.0	20.5	48.0
1916	3.2	8.5	1.8	7.1	2.8	6.9	5.7	18.7	18.9	39.7
1915	5.9	14.2	2.7	10.2	6.0	12.6	12.7	37.3	31.9	66.4
1914	4.7	11.1	2.7	9.5	4.9	10.7	6.1	8.9	23.0	37.6
1913	3.1	7.2	1.7	5.4	3.5	7.3	4.7	13.2	11.7	22.4
1912	2.6	6.2	1.5	4.7	2.7	6.2	3.9	11.3	11.2	21.9
1911	3.5	9.0	2.2	7.5	4.2	9.3	3.7	15.3	9.6	18.1

The mortality from the disease shows a marked sex and color incidence. The mortality of females exceeds that among males in both the white and negro races, but the excess is much more pronounced among negroes. The mortality rate among negroes runs from two to five times the figure for white persons.

Pellagra exacts its heaviest death toll in our Southern states—and, more particularly, from that portion of the colored population which subsists largely on an unbalanced diet. It is probable that the failure of the deathrate to increase during the two latest years is due, in part, to the consumption of brewers' yeast distributed by health departments.

STATE REGULATIONS ON REPORTABLE DISEASES

The greatest single responsibility of our State Health Departments is the control of diseases dangerous to the public health. To effect such control, health officials must know when and where such diseases are occurring. Recognition of this fact brought about the initial step in this country for the compulsory notification of communicable diseases, when Massachusetts, in 1884, passed a law requiring householders and physicians to make immediate reports of all diseases dangerous to the public health. Since then, other states have followed with similar legislation, until now every one of the forty-eight states, and the District of Columbia, has its own requirements. Nearly twenty years ago a model law for morbidity reports was sanctioned at a conference of state and territorial health officials and representatives of the United States Public Health Service.

Nevertheless, there is wide divergence in the present-day regulations and practices of the several states, as to what diseases are "notifiable"; and, indeed, there are good reasons for these varying requirements, for health authorities know that reporting of diseases has not kept pace with that of births and deaths. There is more or less hesitancy, accordingly, about placing certain diseases in the "notifiable" list when health boards know that nothing approaching complete registration will soon be accomplished. In some instances, in fact, the numbers of *deaths* reported, for certain diseases with very low case-fatality rates, are almost as high as the numbers of *cases* reported to have occurred. Again, there are certain diseases, cases of which are practically never encountered in some states.

A certain interest does attach, nevertheless, to points of both agreement and difference in the regulations of the several states; and through the courtesy of the UNITED STATES PUBLIC HEALTH SERVICE,

which has supplied the data to the Metropolitan, we are able at this time to set down some of the more noteworthy facts.*

In the first place, there are only seven diseases which physicians are compelled to report in all forty-eight states and the District of Columbia. These are acute infectious conjunctivitis, diphtheria, meningococcus (epidemic cerebrospinal) meningitis, scarlet fever, smallpox, typhoid fever and tuberculosis—in either one or more than one form.

There are certain states where no notification is required of some of the outstandingly dangerous infections as well as of certain other very common communicable conditions. For example, one state, Texas, does not require reports of measles, whooping cough or poliomyelitis; two states, New Hampshire and Texas, require no notification of chickenpox; and in Nevada and Pennsylvania there is no requirement to report every case of either syphilis or gonorrhea. Two states, Nevada and Wisconsin, and the District of Columbia, do not include anthrax (a very fatal infection to which shepherds, tanners and workers in wool and hair are specially liable) in their lists. States (including the District of Columbia) in which reports of certain other very dangerous or very communicable diseases are not required, number: for influenza, 4; for pneumonia, 6; for lethargic encephalitis, 17; for German measles, 9; for glanders, 13; for malaria (including malarial fever), 10; for mumps, 11; for paratyphoid fever, 13; for rabies (in man), 8; for septic sore throat, 15; and for tetanus, 16.

Certain states stand alone in requiring reports of certain diseases and conditions. For example, West Virginia requires its physicians to report every instance in which a human being is bitten by an animal having or suspected of having rabies; New Jersey, every case in which a person has been bitten by any animal; Illinois, every case of dog bite; and in Massachusetts, all dog bites requiring anti-rabic treatment must be reported. Ohio exacts reports of milk sickness; Louisiana, of rat bite fever; Iowa, of acute rheumatic fever, and Missouri, of scurvy. In Maryland, there is a requirement for the reporting of tropical diseases; and in North Dakota, all parasitic skin diseases are notifiable. California and Illinois are the first states to make psittacosis reportable.

Now and then a state requires reports of certain non-communicable conditions. For example, the Louisiana regulations include congenital deformities, and those for Minnesota include any defect, injury, or disease of a continuous nature or which might permanently handicap

*It is possible that a review by State health authorities would show some changes of which the U. S. P. H. S. had no information at the time these data were supplied.

the child (in a child of pre-school age, or of school age, but not attending school).

Only in comparatively recent years have any of the states made cancer cases reportable. Twelve states now have this requirement, but the list does not include a single New England or Middle Atlantic state.

Thus, while public health administrators agree that prompt information about where, when, and under what conditions certain diseases are occurring is necessary for their control, opinion as to whether many diseases should be made reportable is by no means crystallized. It is much to be hoped that the diversity of practice which now prevails will soon give way to the more general adoption of regulations which have proved their worth in the states where public health administration is best developed.

HEALTH RECORD FOR MAY, 1932

Health conditions up to the end of May have continued to be better than ever before during the like period of the year. This is shown by the unprecedentedly low deathrate of 9.2 per 1,000 among the many millions of Industrial policyholders of the Metropolitan Life Insurance Company in the United States and Canada. The previous low point for the January to May period was 9.5—recorded in 1930; last year's figure was 9.8. Among these insured persons living in the Pacific Coast and Mountain States, the deathrate so far this year is three per cent. below the previous minimum; in the rest of the United States it is 2.5 per cent. lower than ever before; and among about 1,200,000 insured Canadians four per cent. lower.

For the month of May there was registered the lowest deathrate (8.5 per 1,000), with a single exception, ever recorded for that month of the year. The exception was May, 1931, when the rate was 8.4.

Large drops in the rates for three important causes of death have been the chief factors in making 1932, to date, the best of all health years. The record for tuberculosis is the most noteworthy item. The mortality for all forms of tuberculous disease, at the end of May, was more than ten per cent. below the 1931 figure for the like part of the year; in two years, the reduction has amounted to 14.6 per cent. Inasmuch as that part of the year in which the highest mortality from tuberculosis always occurs is now past, it is quite safe to predict that not only will a new low point be reached this year in the deathrate, but that the reduction will be a large one. The mortality from pneumonia is also lower than it has ever been during the winter and spring

seasons. The decline, as compared with the first five months of 1931, is 20.6 per cent. A still greater drop (27 per cent.) is in evidence for influenza. The deathrate for accidents is 5.7 per cent. below that for the like part of last year, and the figure for automobile fatalities is 4.9 per cent. lower. Diseases of pregnancy and childbirth are now causing fewer deaths than ever before.

No important diseases except cancer and diabetes have registered noteworthy increases during 1932. The mortality from cancer is much higher than ever before, with a rise of nearly eight per cent. since 1931, and of nearly seventeen per cent. in two years. The rise in the diabetes deathrate to date amounts to 5.2 per cent.

The deathrate in the general population of the large cities of the United States during May, was 11.5 per 1,000 estimated population, as compared with 12.5 in April and 11.9 in May, 1931. Only two diseases, measles and typhoid fever, were more prevalent during May than in April. Comparison with May of last year shows that there was more sickness in 1932 from influenza, scarlet fever and typhoid fever, with fewer reported cases of diphtheria, measles, poliomyelitis and smallpox.

Among the outstanding health activities reported recently are the following: The ROCKEFELLER FOUNDATION has provided for an extension of an investigation of the chemistry and pharmacology of morphine, with the object of removing the dangerous properties of the drug. This study has been carried on at the universities of Michigan and of Virginia under the auspices of the NATIONAL RESEARCH COUNCIL through its Drug Addiction Committee. Announcement was made of the establishment of an institute for medical research in Philadelphia under the direction of Dr. LEONARD G. ROWNTREE, now Director of Clinical Investigation, MAYO CLINIC, Rochester, Minnesota. A plan for a state-wide campaign for immunization of children against diphtheria was recently approved by the Council of the MEDICAL SOCIETY OF VIRGINIA. The campaign will be organized on a county basis through the cooperation of county boards of health with local physicians, who will together arrange a programme of clinics for each county. A $2,000,000 foundation to aid investigations, on a world-wide basis, into the cause and cure for cancer was launched in Philadelphia under the presidency of WILLIAM H. DONNER, who created the fund. The GEORGE S. COX MEDICAL INSTITUTE FOR RESEARCH INTO THE CAUSE AND CURE OF DIABETES was opened recently at the University of Pennsylvania Hospital, in Philadelphia.

The following table shows the mortality among Industrial policyholders for May, 1932; April, 1932, and May, 1931, together with the cumulative rate for the first five months of each year.

METROPOLITAN LIFE INSURANCE COMPANY

Deathrates* per 100,000 for Principal Causes Premium-Paying Business in Industrial Department (Annual Basis)

MONTHS OF MAY, 1932; APRIL, 1932, AND MAY, 1931

CAUSES OF DEATH	ANNUAL RATE PER 100,000 LIVES EXPOSED*				
	May, 1932	April, 1932	May, 1931	Cumulative January to May	
				1932	1931
TOTAL—ALL CAUSES	848.0	957.8	843.6	924.0	975.3
Typhoid fever	1.0	.6	1.6	1.1	1.2
Measles	3.2	2.4	5.9	2.8	4.7
Scarlet fever	4.3	4.7	3.9	4.1	4.1
Whooping cough	3.0	4.9	3.4	3.8	3.7
Diphtheria	3.0	4.5	4.2	4.9	5.0
Influenza	18.7	37.1	16.9	28.2	38.6
Tuberculosis (All forms)	71.4	78.7	79.7	73.8	82.1
Tuberculosis of resp'y system	63.4	68.9	70.1	65.6	72.8
Cancer	86.5	90.1	77.6	89.3	82.9
Diabetes mellitus	22.6	25.2	18.9	24.3	23.1
Cerebral hemorrhage	62.3	66.2	60.5	67.0	66.7
Organic diseases of heart	157.4	169.3	145.6	167.4	166.9
Pneumonia (All forms)	69.6	97.6	72.0	91.6	115.3
Other respiratory diseases	9.3	10.3	10.3	11.0	13.2
Diarrhea and enteritis	7.4	8.5	8.8	8.1	9.9
Bright's Disease (Chronic nephritis)	65.5	73.5	64.5	72.5	72.8
Puerperal state	9.8	10.3	10.4	10.8	11.9
Suicides	11.4	11.7	9.6	10.6	9.6
Homicides	5.3	5.9	7.3	6.1	6.6
Other external causes (excluding suicides and homicides)	47.7	49.8	51.9	49.7	52.7
Traumatism by automobiles	16.2	16.0	18.2	17.5	18.4
All other causes	188.6	206.2	190.6	197.2	204.2

*All figures in this table include insured infants under one year of age. The rates for 1932 are subject to slight correction, since they are based on provisional estimates of lives exposed to risk.

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DEATHRATES
FROM ALL CAUSES

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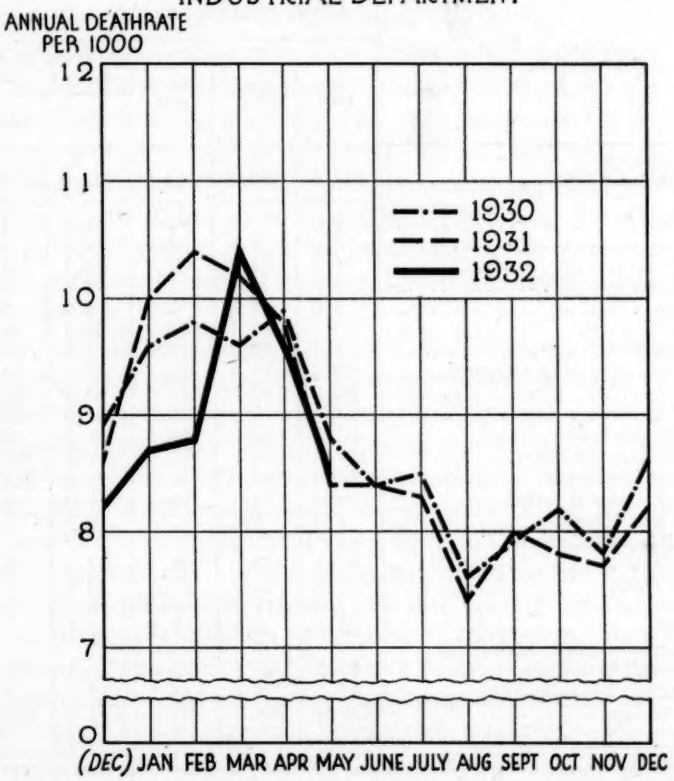
INDUSTRIAL DEPARTMENT



1930	9.6	9.8	9.6	9.9	8.8	8.4	8.5	7.6	7.9	8.2	7.8	8.6
1931	10.0	10.4	10.2	9.8	8.4	8.4	8.3	7.4	8.0	7.8	7.7	8.2
*1932**	8.7	8.8	10.4	9.6	8.5							

* *Rates for 1932 are provisional*

METROPOLITAN LIFE INSURANCE COMPANY PRESS
NEW YORK, U.S.A.
78136